

CLAIMS

What is claimed is:

1. Optical sheeting including polyurea.
2. The sheeting of Claim 1, wherein the sheeting includes microstructures that include polyurea.
3. The sheeting of Claim 1, wherein the optical sheeting includes at least one of cube-corner prisms, open-faced cube-corner prisms, linear prisms, lenticular lenses, cylindrical lenses, moth-eye structures, Fresnel lenses, Fresnel lens arrays, lenslets, surface relief diffusers, diffractive structures, light scattering structures, and fish-eye lens arrays.
4. The sheeting of Claim 1, where the optical sheeting includes at least one of a dye or a pigment.
5. The sheeting of Claim 1, wherein the sheeting includes a fluorescent colorant.
6. The sheeting of Claim 5, wherein the fluorescent colorant includes a xanthene-based fluorescent dye.
7. The sheeting of Claim 5, wherein the fluorescent colorant includes a dye selected from the group consisting of pyranines, anthraquinones, benzopyrans, thioxanthenes, and perylene imides.
8. The sheeting of Claim 5, wherein the fluorescent colorant includes a dye selected from a group consisting of fluoresceins, rhodamines, eosines, phloxines,

uranines, succineins, sacchareins, rosamines, rhodols, pyranines, anthraquinones, benzopyrans, thioxanthenes, and perylene imides.

9. The sheeting of Claim 1, wherein the optical sheeting is colored.
10. The sheeting of Claim 1, wherein the optical sheeting includes polymer having a plurality of microstructures disposed therein.
11. The sheeting of Claim 1, wherein the optical sheeting includes a plurality of two-sided retroreflective components disposed along a substrate.
12. The sheeting of Claim 11, wherein the components are dispersed in polyurea.
13. The sheeting of Claim 1, wherein the optical sheeting is for use in a backlit screen.
14. The sheeting of Claim 1, wherein the polyurea is an aromatic or aliphatic polyurea.
15. The sheeting of Claim 1, wherein the polyurea is formed from an isocyanate prepolymer and amine resin.
16. The sheeting of Claim 15, wherein the polyurea includes a polyfunctional polyol.
17. The sheeting of Claim 15, wherein the isocyanate prepolymer includes a low aliphatic polyisocyanate resin based on hexamethylene diisocyanate (HDI).

18. The sheeting of Claim 15, wherein the isocyanate prepolymer includes a low viscosity solvent-free polyfunctional aliphatic polyisocyanate resin based on hexamethylene diisocyanate (HDI).
19. The sheeting of Claim 15, wherein the amine resin has an amine value of between about 100 and 300.
20. The sheeting of Claim 15, wherein the polyurea further includes a polyol.
21. The sheeting of Claim 20, wherein the polyol includes a branched polyether polyol.
22. The sheeting of Claim 20, wherein the polyol has a hydroxyl number in the range of between about 25 and 400.
23. The sheeting of Claim 20, wherein the polyol is difunctional.
24. The sheeting of Claim 1, wherein the sheeting includes one or more light stabilizers.
25. Optical sheeting that includes optical components disposed on a sheet that includes polyurea.
26. The optical sheeting of Claim 25, wherein the optical components include at least one of cube-corner prisms, open-faced cube-corner prisms, linear prisms, lenticular lenses, moth-eye structures, lenses, Fresnel lens arrays, lenslets, and fish-eye lens arrays.

27. The optical sheeting of Claim 25, wherein the optical components include polyurea.
28. A plurality of retroreflective components that are retroreflective on a first side and on a second side, the components being dispersed in polyurea.
29. A structure comprising optical components dispersed in a polyurea binder.
30. The structure of Claim 29, wherein the optical components include two-sided retroreflective cube-corner prisms.
31. The structure of Claim 30, wherein the cube-corner prisms include open-faced cube-corner prisms.
32. A method for forming a sheet that includes polyurea, comprising:
 - providing a carrier substrate;
 - depositing polyurea on the carrier substrate;
 - allowing the polyurea to at least partially cure to form the sheet that includes polyurea; and
 - removing the carrier substrate.
33. The method of Claim 32 wherein a sheet that includes polyurea, further includes applying a second carrier substrate over the polyurea prior to curing.
34. The method of Claim 33, wherein a nip roller is used to control a thickness of the sheet.

35. A method for forming polyurea comprising:
- a) preparing a first premix by mixing trifunctional polyol with difunctional isocyanate;
 - b) preparing a second premix by mixing polyfunctional isocyanate with difunctional polyol and further mixing in difunctional isocyanate;
 - c) mixing the first premix with the second premix to obtain a substantially homogeneous prepolymer mixture; and
 - d) mixing the substantially homogeneous prepolymer mixture with an amine.
36. The material of Claim 35, further comprising forming a sheet or film from the polyurea.
37. The method of Claim 35, further comprising forming microstructures from the polyurea.
38. A method for forming polyurea comprising:
- a) preparing a first premix by mixing trifunctional polyol with excess difunctional isocyanate to end cap substantially all hydroxyl groups;
 - b) preparing a second premix by:
 - i. capping polyfunctional isocyanate with difunctional polyol; and
 - ii. end-capping the mixture in step i with excess difunctional isocyanate to convert substantially all hydroxyl groups to isocyanates;
 - c) mixing the first premix with the second premix to obtain a substantially homogeneous prepolymer mixture; and
 - d) mixing the substantially homogeneous prepolymer mixture with an amine resin to form the polyurea.

39. The method of Claim 38, further comprising forming optical sheeting from the polyurea.
40. The method of Claim 38, further comprising forming optical microstructures from the polyurea.
41. The method of Claim 38, further comprising mixing a fluorescent dye into the polyurea.
42. Optical sheeting including polyurea formed from the method of Claim 38.
43. A method for forming polyurea sheeting, comprising:
 - dispensing an amine resin onto a substrate;
 - dispensing an isocyanate prepolymer onto the substrate;
 - allowing the amine resin and the isocyanate prepolymer to at least partially diffuse into each other; and
 - winding up the substrate after the amine resin and isocyanate prepolymer have at least partially reacted and cured to form the polymer sheeting.
44. The method of Claim 43, wherein the substrate is a first substrate, further comprising applying a second substrate to sandwich the polyurea sheeting between the first substrate and the second substrate.
45. The method of Claim 44, further comprising preheating at least one of the substrates.
46. The method of Claim 43, further comprising vibrating the substrate to facilitate diffusion.

47. The method of Claim 43, further comprising dispensing at least one of a dye, pigment, or fluorescent colorant onto the substrate.
48. A method for forming polyurea sheeting, comprising:
 - providing a first substrate having a layer of isocyanate prepolymer thereon;
 - providing a second substrate having a layer of amine resin thereon; and
 - pressing the layer of isocyanate prepolymer against the layer of amine resin to at least partially mix the isocyanate prepolymer with amine resin to form the polyurea sheeting.
49. The method of Claim 48, further comprising pressing the layer of isocyanate prepolymer against the amine resin with a nip roller.
50. The method of Claim 49, further comprising winding up the polyurea sheeting.
51. The method of Claim 48, further comprising heating at least the isocyanate prepolymer or the amine resin to facilitate mixing thereof.
52. An optical structure having a microstructured surface on a first side and a microstructured surface on a second side, the structure including polyurea.
53. The optical structure of Claim 52, wherein the microstructured surface for each side is formed from a thermoplastic.
54. The optical structure of Claim 52, wherein the structure includes an ultraviolet cured thermoset material.

55. An optical sheet having at least one microstructured surface formed from polyurea.
56. A polyurea optical structure comprising a one-component polyurea layer attached to a first side of a two-component polyurea layer.
57. The structure of Claim 56, further comprising a second one-component polyurea layer attached to a second side of the two-component layer.
58. The structure of Claim 56, further comprising a microstructured layer attached to at least one of the one-component polyurea layers.
59. The structure of Claim 56, wherein the two-component polyurea layer includes an isocyanate prepolymer and an amine resin.
60. The structure of Claim 56, further comprising a layer attached to a second side of the two-component polyurea layer.
61. The structure of Claim 60, further comprising a one-component polyurea layer attached to the layer attached to the second side of the two-component polyurea layer.
62. A method for forming a polyurea optical structure, comprising:
 - providing a one-component polyurea layer on a carrier substrate;
 - providing a two-component polyurea layer on the one-component polyurea layer, the two-component polyurea layer contacting the one-component polyurea along a first side of the two component polyurea layer;
 - providing a one-component polyurea layer on a second side of the two-component polyurea layer; and

providing a layer on the one-component polyurea that is provided on the second side of the two-component polyurea layer.

63. The method of Claim 62, further comprising removing the carrier substrate and forming a microstructured layer on the exposed one-component polyurea layer.
64. The method of Claim 63, further comprising attaching the structure to a garment.
65. The method of Claim 63, further comprising removing the layer that is provided on the one-component polyurea provided on the second side of the two-component polyurea layer.
66. A method for forming a polyurea optical structure, comprising:
 - providing a one-component polyurea layer on a carrier substrate;
 - providing a two-component polyurea layer on the one-component polyurea layer, the two-component polyurea layer contacting the one-component polyurea along a first side of the two-component polyurea layer; and
 - providing a layer on a second side of the two-component polyurea layer.
67. The method of Claim 66, further comprising removing the carrier substrate attached to the one-component polyurea layer and forming a microstructured layer on the exposed one-component polyurea layer.
68. The method of Claim 66, further comprising forming a one-component polyurea layer on the layer that is attached to the second side of the two-component polyurea layer.

69. A polyurea optical structure comprising a two-component polyurea layer attached along a first side of the two-component polyurea layer to a microstructured layer.
70. The structure of Claim 69, further comprising a layer attached to a second side of the two-component polyurea layer.
71. The structure of Claim 69, further comprising a one-component polyurea layer disposed between the microstructured layer and the two-component polyurea layer.